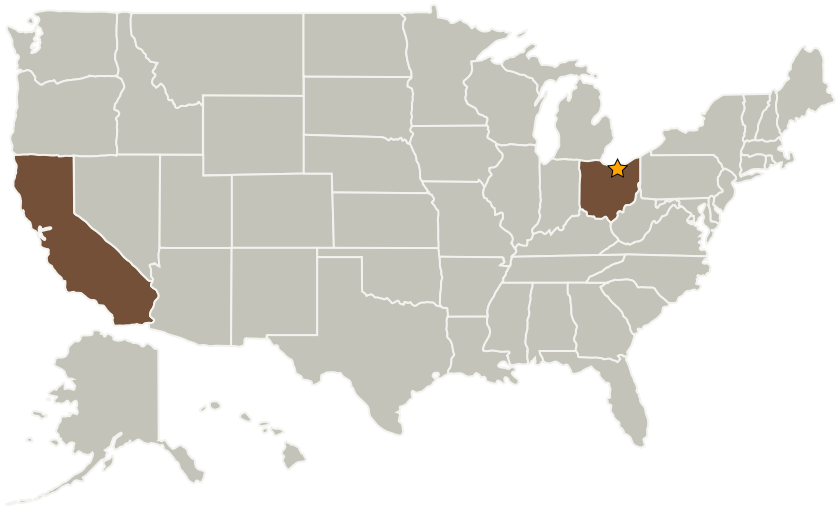
High Fidelity Regolith Simulation Tool for ISRU Applications, Phase I

Completed Technology Project (2008 - 2008)

Project Introduction

NASA has serious unmet needs for simulation tools capable of predicting the behavior of lunar regolith in proposed excavation, transport and handling systems. Current simulation tools do not include the effects of triboelectric and photo-ionization induced charges on regolith particles. Existing DEM or FE models largely focus on coarse smooth non-brittle particles and lack adequate fidelity for fine cohesive powders comprised of friable particles with irregular shapes. As such, they are inadequate for assessing the reliability of regolith excavation and handling systems, and even less so for evaluation of engineering trade offs between total system mass, power and energy consumption. Grainflow Dynamics proposes to develop a high-fidelity DEM model incorporating a new charge-spot model for electrostatic forces arising from localized charge patches on the surfaces and in the interiors of individual particles, and also including an innovative new comprehensive cohesive-contact model. Grainflow Dynamics further proposes to demonstrate the ability of the new cohesive-contact model to mimic the compaction and dispersion behavior of lunar regolith simulants JSC-1A and JSC-1AF. This work will lead to an improved engineering design tool that can be used by NASA engineers and contractors developing designs for ISRU equipment, to evaluate reliability of various configurations, and the trade-offs of system designs.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Grainflow Dynamics, Inc.	Supporting Organization	Industry	Livermore, California

Primary U.S. Work Locations	
California	Ohio

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Otis Walton

Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.3 Simulation
    - TX11.3.7 Multiscale, Multiphysics, and Multifidelity Simulation